Letters to the Editor.

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Radiation from the Carbon Arc.

AN application of Merton and Nicholson's form of the wedge method has been made to the study of the intensity distribution in typical stellar spectra. In the late type spectra (including the sun), which are sufficiently bright at the red end, the energy curves give a marked depression from 0·50–0·67μ—a result not obtained by other observers. As the spectrum of the carbon arc, assumed to radiate as a black body at a temperature of 3750° Abs., is used to remove the colour curve of the plate, a possible cause of this depression, which is common to all stellar spectra that have been observed in the red, would lie in an intensity distribution in the carbon arc differing from that assumed.

In order to determine the intensity distribution in the spectrum of the positive crater of the carbon arc, the acetylene flame was used as a standard. The intensity distribution in a cylindrical flame of specified dimensions burning acetylene generated from commercial calcium carbide has been carefully determined by Coblentz with the bolometer (Bureau of Standards, Scientific Papers No. 279, 1916, and No. 362, 1920). To reproduce as closely as possible the conditions employed by Coblentz, a burner was used giving a cylindrical flame of the specified dimensions, and the acetylene used was obtained from three different sources: two cylinders containing acetylene compressed in acetone and a simple gasometer which generated gas from commercial calcium carbide. From 0·40–0·60μ the intensity distributions in the flames from these three sources were in good agreement. From 0·60–0·675μ there were systematic differences with a range of 8 per cent., due probably to the varying quality of the acetylene. In this part of the spectrum mean intensities were used as giving the closest approximation to Coblentz's conditions. Some initial experimental difficulties were encountered owing to non-uniform illumination of the wedge by the flame which could not be detected by the usual methods. It was found that reversal of the wedge on the slit furnished a very sensitive test of uniformity, and by the use of this method an arrangement of apparatus was secured which gave uniformity of illumination within the limits of the accidental errors of the wedge method.

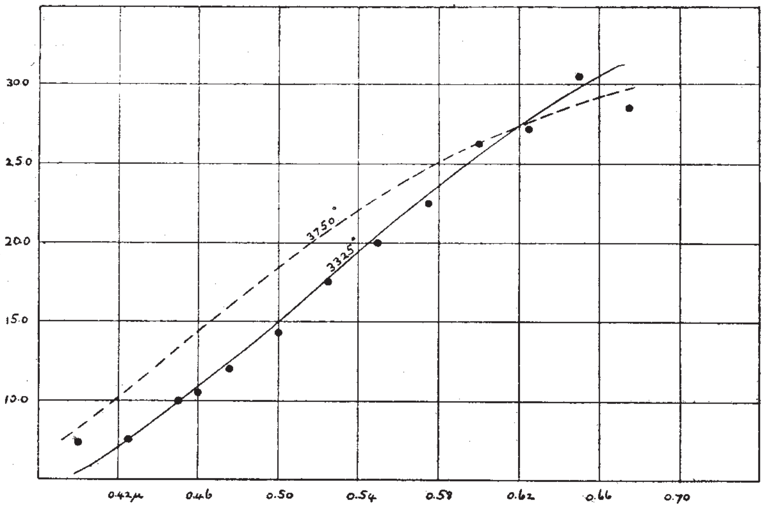

FIG. 1.—Intensity distribution in spectrum of positive crater carbon arc.

When the initial difficulties had been overcome a series of eight spectra of the acetylene flame was obtained on Ilford panchromatic plates. At the same time five spectra of the positive crater of the carbon arc were secured, cored carbons being used with a current of 5·7 amperes. The heights of these wedge spectra were measured to two different densities at various wave-lengths by means of a simple form of microphotometer devised for that purpose. The two series of measures differed by less than 2 per cent. The final mean absolute intensities of the carbon arc for various wave-lengths are shown in Fig. 1 by black circles. The mean probable error of these intensities is 1·7 per cent., the mean probable error of a single plate being 5·7 per cent. These mean probable errors would be considerably reduced if the intensity at 0·675μ were not used, the intensity at this point being subject to large accidental errors on account of the rapidly changing colour-curve of the plate.

It will be noticed that the observed intensities depart considerably from the intensities computed on the assumption of black-body radiation at a temperature of 3750° Abs. (shown by the dotted curve). The use of the observed values of the intensity distribution gives results for stellar spectra more in accord with those obtained by previous observers. There is still outstanding, however, in the case of the sun a depression requiring further investigation.

Two hypotheses may be advanced to account for the observed intensity distribution:—

(1) The carbon arc radiates as a black body at a temperature of 3750° Abs., but there is an absorption band with its centre at 0·50μ, due possibly to the incandescent carbon particles in the arc flame. Coblentz has shown that at 2360° Abs. these carbon particles have an absorption band with centre at 0·60μ (Bureau of Standards, Scientific Paper No. 156, 1911). At the temperature of the arc flame this absorption band would suffer a shift to the violet, bringing its centre approximately in the observed place. The advantage of this hypothesis is that it is in accord with previous determinations of the arc temperature by such various methods as (*a*) the calorimetric method used by Violle, (*b*) the wave-length of maximum energy used by Lummer and Pringsheim, (*c*) Féry's determination from the total radiation, and (*d*) various determinations by optical pyrometers using an approximately monochromatic band in the red. This hypothesis is represented graphically in Fig. 1 by the dotted curve showing the intensity distribution of a black body at 3750° Abs. computed from Wien's law, so as to bring it into approximate agreement with the observed values from 0·600–0·675μ.

(2) The carbon arc radiates as a black body at a temperature of 3325° Abs. This hypothesis is represented by the full curve in Fig. 1, which fits the observed values fairly well. It can be brought into accord with previous work only by supposing that the commercial cored carbons used burned at a lower temperature than those carbons used by other investigators. Wanner has found differences of 200° depending upon the carbons used.

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It is evident, if the carbon arc is to be used as a standard of intensity distribution for photographic spectrophotometry—and it is a very convenient standard—that its intensity distribution should be very carefully determined against a laboratory black body.
H. H. PLASKETT.

Dominion Astrophysical Observatory,
Victoria, B.C., June 18.

The Discovery of Large Quartzite Implements of Rostro-carinate and Early Palæolithic Types in Uganda.

THROUGH the kindness of Mr. E. J. Wayland, of the Geological Department, Entebbe, Uganda, I have become acquainted with an important discovery, made by him in Uganda, of a considerable number of large quartzite implements of rostro-carinate and Early Palæolithic types. Mr. Wayland has asked me to publish my opinion of the cultural relationship of the specimens, of which he sends me drawings, to the beak-shaped implements found beneath the Red Crag of East Anglia, and I may say at once that there would seem to be little doubt that the latter, though possibly more ancient, are clearly "related" to the East African artefacts.

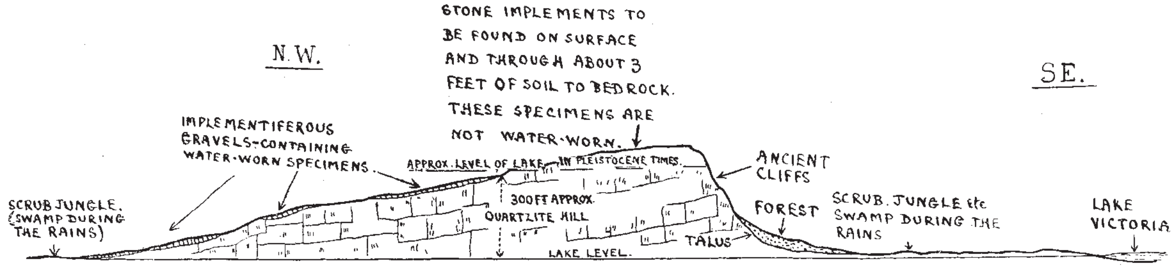
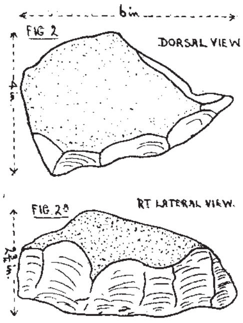

STONE IMPLEMENTS TO BE FOUND ON SURFACE AND THROUGH ABOUT 3 FEET OF SOIL TO BEDROCK. THESE SPECIMENS ARE NOT WATER-WORN.
N.W.
SE.
IMPLEMENTIFEROUS GRAVELS-CONTAINING WATER-WORN SPECIMENS.
APPROX. LEVEL OF LAKE IN PLEISTOCENE TIMES.
ANCIENT CLIFFS
SCRUB JUNGLE. (SWAMP DURING THE RAINS)
300 FT APPROX.
QUARTZITE HILL
FOREST
SCRUB. JUNGLE etc SWAMP DURING THE RAINS
LAKE VICTORIA
TALUS
LAKE LEVEL.

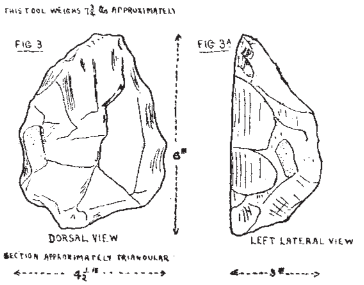
FIG. 1.—Rough diagrammatic sections (not drawn to scale) through Msozi Hill, Sango Bay, Buddu, Uganda.

The exact localities where these new discoveries have been made are: (*a*) on the slopes and upon the summit of Msozi Hill, Sango Bay, Buddu, Uganda, and (*b*) at Kisiba, Tanganyika Territory. The accompanying diagrammatic cross-section (Fig. 1), copied from the drawing sent to me by Mr. Wayland, will make clear the positions in which the quartzite implements of Msozi Hill are found, and explain their discoverer's views as to the geological age of the specimens. As will be seen from an examination of Fig. 1, there are deposits of gravel on the slopes of Msozi Hill ("Quartzite Hill" of diagram) containing water-worn implements. On the summit of the hill, however, no gravel occurs, but Mr. Wayland finds upon the surface, and scattered through about 3 ft., of the soil, which there covers the bedrock, a number of specimens (of the same types as those found in the gravel) which are not water-worn. He observes, further, that the surface of Lake Victoria (shown to the right in Fig. 1) now rests at, approximately, 300 ft. lower than the level at which the unrolled implements occur, and he draws the conclusion that, when the people lived who fashioned the implements he has found, "Lake Victoria was 300 ft. above its present altitude, a state of things which, according to my showing, obtained during the Pleistocene Glacial period." It is thus clear that Mr. Wayland regards the quartzite specimens with which this letter deals as of considerable geological antiquity, a conclusion which, in my judgment, appears to be sound and in accord with the evidence he puts forward. From the numerous drawings of implements which have been sent to me, I have selected five which, while being representative of the majority of the implements figured, will, I think, enable me to fulfil Mr. Wayland's request that I should demonstrate the relationship of the Uganda specimens to the sub-Crag rostro-carinates of East Anglia.

The implement illustrated in Figs. 2 and 2A is, without any question, similar to many which have been found in the sub-Crag detritus-bed, and exhibits the characteristics of a broad, low rostro-carinate of primitive form, in which the keel, or carina, does not extend far back towards the posterior region of the specimen (Fig. 2A), and the dorsal surface (Fig. 2) is composed of unflaked "cortex." Figs. 3 and 3A illustrate a massive specimen—weighing approximately $7\frac{3}{4}$ lb.—which is somewhat similar in form to the implement just described. As will be noticed, the more or less flat ventral surface, together with the profile of the rostro-carinate form (Fig. 3A), is retained, but the dorsal surface (Fig. 3) is composed



FIGS. 2 and 2A.—Rostro-carinate implement in quartzite, from Uganda.


THIS TOOL WEIGHS 7¾ lbs APPROXIMATELY
FIG 3
FIG 3A
6"
DORSAL VIEW
LEFT LATERAL VIEW
SECTION APPROXIMATELY TRIANGULAR
4½"
3"

FIGS. 3 and 3A.—Massive quartzite implement from Uganda, of a form transitional between the rostro-carinate and the "batiform" Palæolithic specimens.

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